

CHEST TUBE AND LINES – USE WITH PRECAUTION

*Dr. Abhinav Aggarwal

MBBS, MD (Radiodiagnosis), Fellowship Onco-Radiology, Fellowship Musculoskeletal Radiology, Fellowship Cardiovascular Radiology, Consultant Radiologist, Department of Radiology, Mata Chanan Devi Hospital, New Delhi, India-110058.

***Corresponding Author: Dr. Abhinav Aggarwal**

MBBS, MD (Radiodiagnosis), Fellowship Onco-Radiology, Fellowship Musculoskeletal Radiology, Fellowship Cardiovascular Radiology, Consultant Radiologist, Department of Radiology, Mata Chanan Devi Hospital, New Delhi, India-110058.

Article Received on 06/03/2020

Article Revised on 26/03/2020

Article Accepted on 15/04/2020

ABSTRACT

Chest tubes are one of the most commonly used invasive instruments in routine practice. Although the technique of insertion of these tubes (especially nasogastric tube) is fairly simple, it is rarely practiced meticulously. Malpositioned chest tubes can lead to severe life threatening complications, especially since these patients are already suffering from long-term illnesses and are considerably debilitated. Chest radiographs are still the most commonly used method of diagnosis of a tube insertion misadventure, however newer modalities are now available which also aid in correct placement of these tubes.

KEYWORDS: Chest tubes, pleural effusion, malpositioned tubes, life threatening, complications.

INTRODUCTION

Chest tubes form a major part of management of admitted patients especially in critical care units. These are usually inserted blindly at bedside and carry the risk of serious life threatening complications.^[1] Due to the ease of administration and multipurpose use nasogastric tubes are the most commonly used of the lot. One of the main uses of the nasogastric tube is enteral feeding.^[2] Maintenance of enteral nutrition often represents an important part of treatment of patients especially those who are unable to take normal oral feeds. Good gastrointestinal system maintains mucosal integrity, increases blood flow to gut, reduces bacterial translocation and increases immunity. A number of thoracic/ non-thoracic and vascular/ non-vascular complications have been described with use of nasogastric tubes. We here discuss the methods of verification of correct placement of chest tubes and their associated complications and the role of radiology in it.

Methods for correct placement and verification

Nasogastric tubes are usually inserted blindly. The most common identification method employed is the one where after insertion of approximately 15-20cm of tube the head is flexed bringing the chin closer to the chest. This narrows the trachea and opens the esophagus. If the measurements for optimum placement of tube into the fundus are made, then approximately 50 to 60cm of tube will need to be inserted. This will lead to almost the whole of tube being placed inside the patient.^[3,4,5]

Many traditional bedside clinical signs and tests are available like: ease of placement, absence of coughing, visual inspection of tube aspirate, and a positive epigastric auscultation. These signs are not always accurate and even some clinical tests like bubbling of tube under water are sometimes seen in malpositioned nasogastric tubes. 20% false negative gastric confirmation by auscultation has been reported in literature.^[4] Negative blood aspiration test has been advised, since an intravascular placement of tube will lead to fatal air embolism, similar to development of pneumothorax in pleural placement.^[6]

Roubenoff and Ravich proposed a two-step protocol for insertion of nasogastric tubes in 1989. It comprised of taking two chest radiographs, one after insertion of first 30cm of tube and second after full insertion.^[7] The main disadvantage of this method is the time taken and doubled radiation exposure to the patient. Many methods based on biochemical levels of gastric, pleural/pulmonary and intestinal fluids have also been advocated, like pH levels (since gastric pH levels are much lower than pulmonary or intestinal levels), bilirubin levels and end-tidal CO₂ levels (capnography).^[8,9] Capnography when combined with Roubenoff and Ravich has been reported to have a sensitivity and specificity of 100% each.^[2]

More recently endoscopy guided tube placement has been practiced in difficult or previously failed patients and in those where nasojejunal feeding is preferred.^[10]

Complications arising from wrongful insertion

The rate of complications arising from wrongful insertion of nasogastric tubes range from 0.3% to 8%. These can be divided into various thoracic and extra-thoracic categories according to the site of complication and further subdivided into tracheobronchopleural & intravascular and enteral & intracranial respectively. The list includes:-^[7,11,12,5,15,16,17,18]

Thoracic tracheobronchopleural complications

1. Atelectasis, pneumonia ad lung abscess.
2. Bronchial perforation and pleural cavity enetration
 - a. Pneumothorax
 - b. Isocalothorax (enteral feed hydrothorax)
 - c. Empyema and sepsis
 - d. Pleural knotted tube
 - e. Pulmonary hemorrhage
3. In post lobectomy patients – entrapment of bronchial suture line

Thoracic intravascular complications

1. Erosion into retroesophageal aberrant right subclavian artery
2. Right internal jugular vein to right atrium.

Non- Thoracic enteral complications

1. Tube knotting and impaction in the posterior nasopharynx or beyond pylorus
2. Tube kinking
3. Enteric/ esophageal/ duodenal perforation – can lead to mediastinitis
4. Tube obstruction and rupture with syringing
5. Tube breakage

Non- Thoracic intracranial complications

1. Following repair of choanal atresia and transnasaltransphenoidal surgery
2. Following maxillofacial trauma

Various studies have recorded pneumothorax as the most common complication with more than 50% patients requiring chest tube insertion henceforth.^[7] However the

actual rate of mortality as a direct cause of these complications has been reported to be very low at 0.3%.^[19] There are reports of chest tubes being wrongly misplaced in both bronchi of a patient suffering from hypopharyngeal malignancy.^[20] Such incidents can lead to unsuspected medical emergencies.

Patients who are admitted on long-term treatment protocols or are severely debilitated may require multiple tube insertions, like nasogastric, endotracheal tubes etc. These tubes may hamper correct administration of each other. Previously inserted endotracheal tube has known to prevent glottis closure and inhibit swallowing therefore increasing the risk of pulmonary entry of nasogastric tubes.^[21]

Chest radiographs are still the gold standard and most commonly used method of detecting misplaced chest tubes. Although they are not helpful in prevention of wrongful insertion of tubes.^[2] Computed tomography (CT scan) can be used in cases where chest radiographs are insufficient, however they are costlier and less easily available. Most institutes follow the practice of serial radiographs pre and post insertions and removal of chest tubes, especially since chest radiographs can be performed bedside in sick patients.

CASE 1

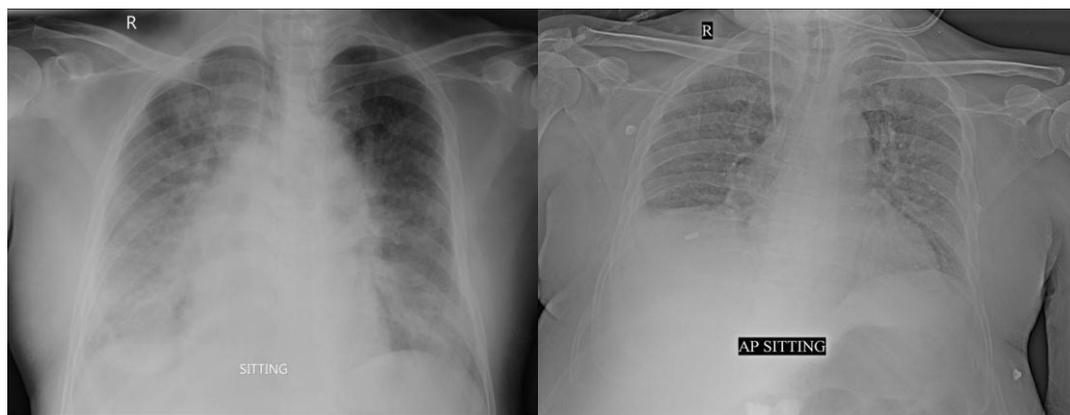


Fig. 1 (a,b): Chest Radiograph showing no pleural effusion on either side in (a); Post nasogastric tube insertion there is development of right pleural effusion due to wrongful insertion of nasogastric tube into right lower lobe bronchus.

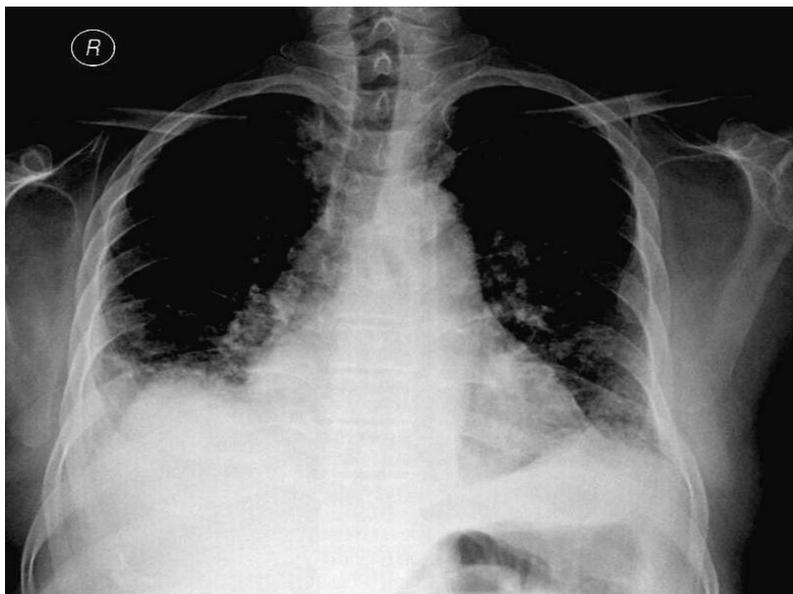


Fig. 1(c): After removal of wrongly inserted nasogastric tube the right pleural effusion was resolved.

CASE 2

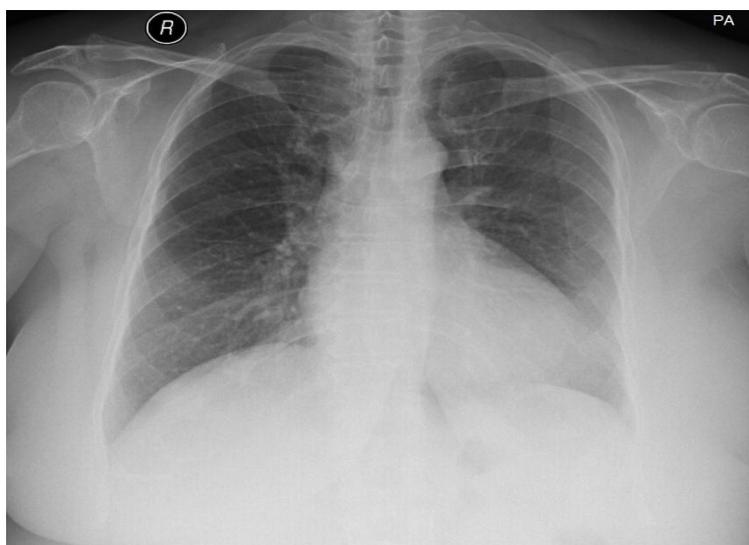


Fig. 2: Pre-op normal PA radiograph of chest.



Fig. 3: (a) Post- operative chest radiograph showing development of air filled cavity in right upper & middle zones with evidence of right pleural effusion. (b) - Lateral cervical radiograph showing radiolucency in prevertebral space. (c) Barium swallow showing concealed esophageal rupture with leakage of oral contrast at D1 level.

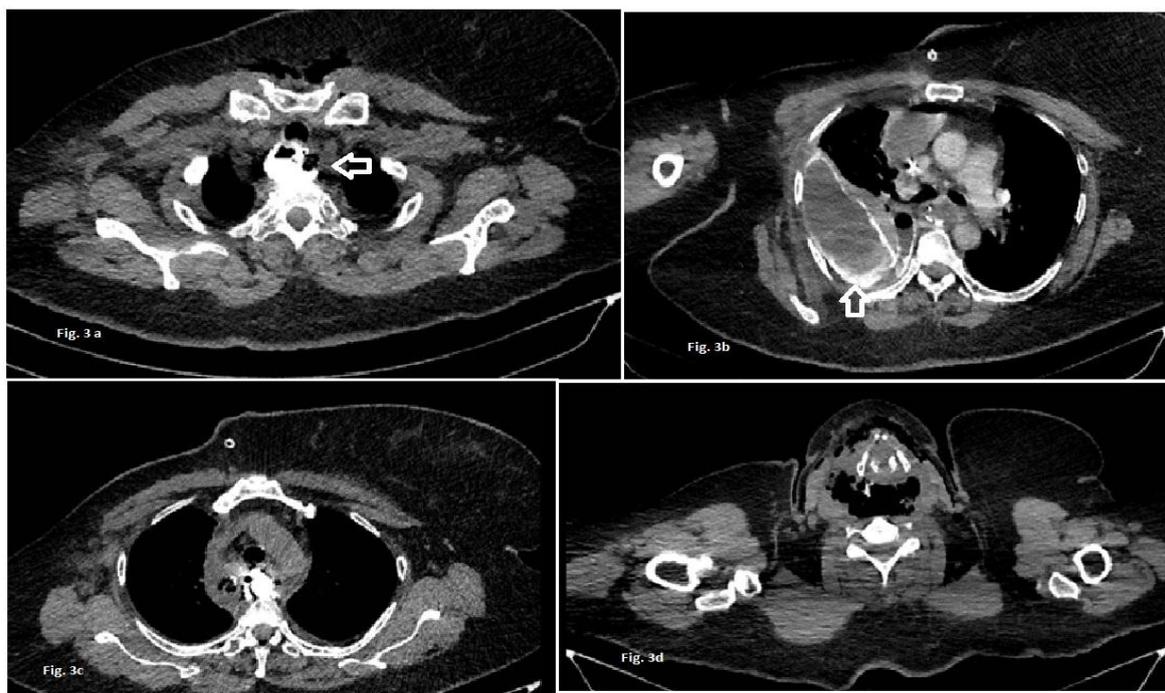


Fig. 4: (a) Axial CT image showing site [white arrow] of esophageal rupture at D1 vertebral body level. (b) Axial CT images showing spillage of oral contrast in mediastinum and right pleural cavity through site of esophageal leak. (c) Mild paraesophageal collection / thickening is seen. (d) Axial CT image showing pneumo-mediastinum extending superiorly into neck (as was seen on lateral cervical radiograph, Fig. 2b).

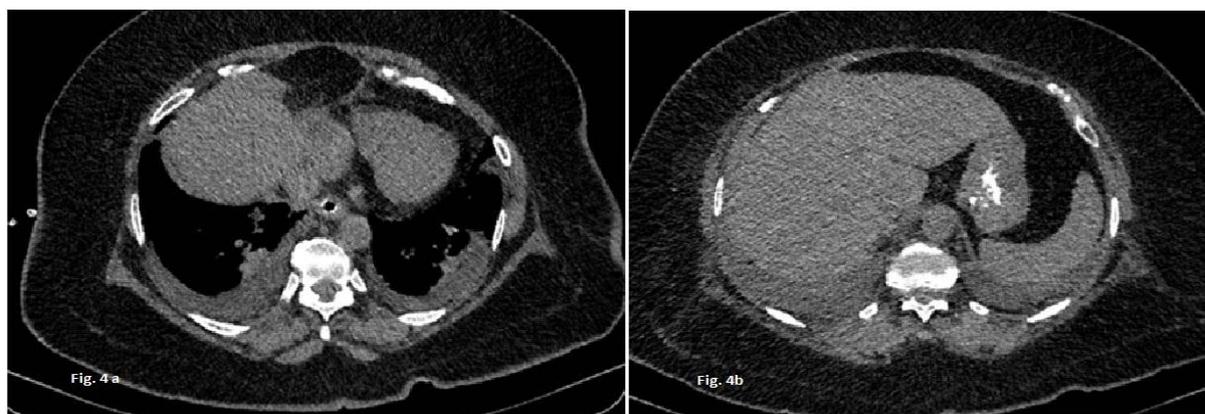


Fig. 5: (a) Axial CT showing bilateral pleural effusions. Distal esophagus appears normal. (b) Axial CT image showing normal stomach.



Fig. 6: The condition of the patient worsened after a few days. (a) Chest radiograph showing severe right hydropneumomediastinum on post-operative day 13. (b) CT was done on post-operative day 14. Axial CT image showing diffuse paraesophageal thickening (white arrow). Tracheostomy tube can be seen in situ. (c) Immediately inter-costal drainage tubes were placed in situ. Bilateral pulmonary infiltrates had also increased. Following this patient was taken up for surgical drainage and repair of esophageal rupture.

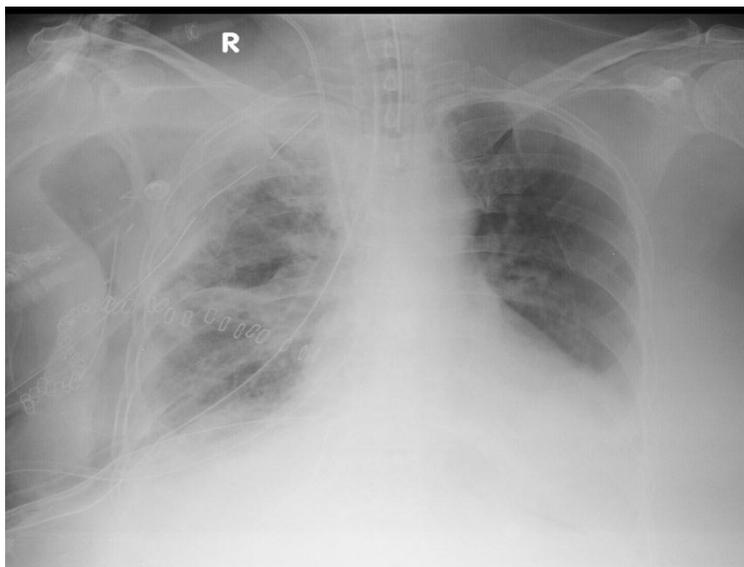


Fig. 7: Chest radiograph taken after surgical intervention showing decreased right pleural effusion with no obvious evidence of pneumothorax. Inter-costal drains are seen in situ.

CASE 3

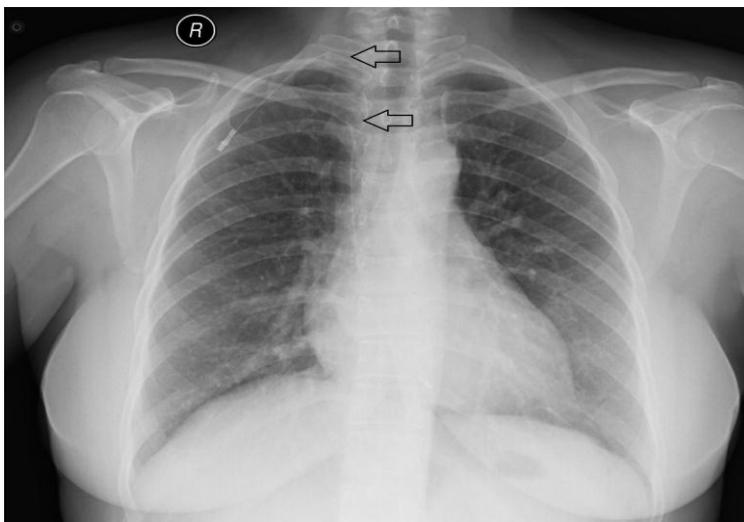


Fig. 8: Chest PA radiograph image showing broken ends (black arrows) of central venous line.



Fig. 9: MIP coronal image showing broken pieces (black arrows) of central venous line lying horizontally in right ventricle. The proximal end of central venous line is seen in subclavian vein.

CONCLUSION

Chest tube insertion should be done with great precaution and by proper technique with pre and post procedure chest radiographs being mandatory in routine practice. Discomfort to the patient should immediately raise suspicion of malpositioned chest tube. Complications arising from malpositioned chest tubes although rare, can be life threatening. High-risk patients like sedated, mentally compromised and ones with previous misadventure should be managed with extra care.

REFERENCES

- Hedge HV, Rao PR. A near miss; malpositioned nasogastric tube in the left bronchus of a spontaneously breathing critically-ill patient. *Trends in anaesthesia & critical care.*, April 2010; 21(2): 94-96.
- Pillai JB, Vegas A, Brister S. Thoracic complications of nasogastric tube: review of safe practice. *Interact Cardio Vasc Thorac Surg*, 2005; 4(5): 429-433.
- Philips DE, Sherman IW, Asgarali S, Williams RS. How far to pass a nasogastric tube. *J R Coll Edinb*, 1994; 39: 295-296.
- Benya B, Lnager S, Morbarhan S. flexible nasogastric feeding tube tip immediately after placement. *Journal of Parenteral and Enteral Nutrition*, 1990; 141: 108-109.
- Dinsmore RC, Benson JF. Endoscopic removal of a knotted nasogastric tube lodged in the posterior nasopharynx. *Southern medical journal*, 1999; 92: 1005-1007.
- Gregory JA, Turner PT, Reynolds AF. A complication of nasogastric intubation: intracranial penetration. *Journal of Trauma-Injury Infection & Critical Care*, 1978; 18: 823-824.
- Roubenoff R, Ravich WJ. Pneumothorax due to nasogastric feeding tubes. Report of four cases, review of literature and recommendations for prevention. *Arch Intern Med*, 1989; 149: 188.
- Metheny NA, Smith L, Stewart BJ. Development of a reliable and valid bedside test for bilirubin and its utility for improving prediction of feeding tube location. *Nurs Res.*, 2000; 49: 302-309.
- Araujo P, Carlos E, Melhando ME, Gutierrez FJ, Maniatis T, Castellano MA. Use of capnometry to verify feeding tube placement. *Critical Care Medicine*, 2002; 30: 2255-2259.
- O'Keefe SJD, Foody W, Gil S. Transnasal endoscopic placement of feeding tubes in the intensive care unit. *Journal of Parenteral and Enteral Nutrition*, 2003; 27: 349.
- Korkola SJ, Stansfield W, Belley G, Mulder DS. Thoracoscopic extraction of a Dobhoff feeding tube knotted in the pleural space. *J Am Coll Surg*, 2001 Dec; 193: 704-705.
- Granier I, Leone M, Gracia E, Geissler A, Durnad-Gasselin J. Nasogastric tube: Intratracheal malposition and entrapment in a bronchial suture. *Ann Fr Anesth Reanim*, 1998; 17: 1232-1234.
- Merchant FJ, Nicholas RL, Bombeck CT. unusual complication of nasogastric esophageal intubation-erosion into an aberrant right subclavian artery. *J Cardiovasc Surg (Torino)*, 1977; 18: 147-150.
- Duthorn L, Schulte SH, Hauser H, Nesser G, Pracki P. Accidental intravascular placement of a feeding tube. *Anesthesiology*, 1998; 89: 251-253.
- Hande A, Nagpal R. intracranial malposition of nasogastric tube following transnasaltranssphenoidal operation. *Br J Neurosurg*, 1999; 5: 205-207.
- Gregory JA, Turner PT, Reynold AF. A complication of nasogastric intubation: intracranial penetration. *Journal of Trauma-Injury Infection & Critical care*, 1978; 18: 823-824.
- Durai R, Venkatraman R, Philip CH. Nasogastric tubes 2:risks and guidance on avoiding and dealing with complications. *Nursing Times*, 2009; 105: 17.
- Agha R, Siddiqui MRS. Pneumothorax after nasogastric tube insertion. *JRSM Short Rep.*, 2011 Apr; 2(4): 28.
- Rassias AJ, Ball PA, Corwin HL. A prospective study of tracheopulmonary complications associated with the placemnt of narrow-bore enteral feeding tubes. *Critical Care*, 1998; 2: 25-28.
- Takwoingi YM. Inadvertent insertion of a nasogastric tube into both main bronchi of an awake patient: a case report. *Cases J.*, 2009; 2: 6914.